

Patent Application of
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for

ELECTRONIC SIGNATURE PROGRAM

Cross References to Related Applications

None.

Background -- Field of Invention

This invention relates to creating and verifying between computers and on computer networks electronic signatures for electronic documents, filings and transaction records.

Background -- Description of Prior Art

An electronic document, legal filing or record of an electronic commercial transaction requires a way to authenticate the parties. Because handwritten signatures on paper have performed the authentication function traditionally, and electronic documents do not allow for this physical method of authentication, electronic substitutes must be found.

2

Until now, two principally different systems have been devised for "signing" electronic documents, but each has one or more significant drawbacks.

One such system, shown in U.S. Pat. 4,405,829 to Rivest et al. (1983) is based upon a technology known as "asymmetric encryption." In this technology, a user generates two mathematically related numbers that are similar to very long passwords, called keys. The so-called private key remains with the issuing user. The other key, denominated the public key, is distributed by the issuer to others for the purpose of verifying communications. The keys are related, but they are not identical. They perform reverse roles. One is used to encrypt information, and the other to decrypt it.

Electronic communications are signed, generally with the private key, in a two step process. First a digest of a message is created with a one way hash function, and then the hash function is encrypted using the private key. The authenticity of the message and its contents can be verified by a recipient as being authentic and sent from the signing party through testing of the message using the public key. Either an altered message or fraudulent sender will be detected by a computer possessing the proper software, the public key, and the digital certificate of the signer. If the message has been altered or the signer did not use the proper private key, the message will be detected as false. This method is useful for electronic authentication.

However, this method of authentication also requires a massive infrastructure for key management and verification by trusted third parties, called certification authorities, who check the identities of key holders, issue certificates to them verifying that they belong to the party who is identified as the holder of the key pair, and maintain lists of active and revoked certificates for use by relying third parties. Determination of authentication requires not only a check of the digital signature on the message, but also of the status of the certificate identifying the signer, which involves accessing the certificate authority and knowing how to check the lists of revoked and suspended certificates. The investment to create and operate a certification authority is considerable.

3

Another difficulty with this technology is that private keys are also susceptible to theft from the computers or devices where they are stored, and when stolen, can be used to commit fraud with virtually no detection until the certificate of the user is revoked by the certification authority with respect to that particular corresponding public and private key pair.

The creation and maintenance of the certification authority infrastructure requires a massive investment in equipment and personnel that results in a relatively high cost to the end user where suitable means are adopted by the certification authority to verify the true identity of a holder of a private key before issuance of a digital certificate to the alleged owner of the key.

Furthermore, in business and legal settings where both parties are required to electronically sign documents, filings or transaction records using their respective private keys and digital certificates, and they are located in or claim citizenship of different legal jurisdictions or countries, there is a possibility for uncertainty or actual conflict in the laws applicable to the transaction. In some countries, users may be required to give copies of the keys to the applicable governmental authority upon pain of punishment. This requirement may compromise the privacy and security of the electronic signatures. Where different legal regimes are involved, such uncertainty or conflict may actually impede the use of the electronic signatures for fear by participants of legal attacks from overzealous authorities or corrupt ones, depending on the reputations of the countries involved and their political regimes.

PenOp, U.S. Pat. No. 5,554,255(1994), and continuation serial number 298,991, U.S. Patent 5,647,017 (1997) and related patents cited therein, adopts a completely different approach to electronic signatures. It uses digital drawing tablets as a basis for digitally capturing a handwritten signature, and then through software stores certain signature characteristics which identify the dynamic movements of the writer's hand as it moves the stylus on the tablet during signature creation, in addition to the image of the signature on the tablet. This stored information is then compared to a subsequently generated signature

to determine if the signature is authentic. If a hash function is captured, digested, and linked to the document, this approach, like the "digital signature" approach of the "asymmetric encryption" can determine any changes that have been made to the document since the signature was applied.

This "dynamic signature" approach avoids the massive infrastructure of the "public key encryption" certification authorities, and the problem of conflicting legal regimes applicable to electronic signing of documents in an international or multi-jurisdictional setting, but it requires the provision of a digital drawing tablet and stylus at each computer workstation where signature is to be accomplished, as well as the related software, which can be a significant system-wide item of cost. In addition, traditional forensic analysis applicable to handwritten signatures does not yet apply to electronic signature analysis, and it may be some time, if ever, before the legal forensic community becomes adept at dynamic signature handwriting analysis. Because there is no way at present for expert analysis of dynamic signatures, the ability to authenticate signatures is arguable at best.

In addition, these technologies are mutually exclusive, in that one cannot incorporate the other, and it is not possible to use them together under prior art.

Objects and Advantages

Accordingly, several objects and advantages of the invention are to provide a new type of electronic signature that does not depend upon the massive certification authority infrastructure of digital signatures based on asymmetric encryption or the hardware and software investment of dynamic signatures; further that it uses only one signature key of the server computer located in and subject to the jurisdiction only of the political authority of the server computer, further that it automatically generates and affixes a date and time stamp as proof of those parameters at the time of the signature; further that it eliminates the need for development of a discipline that does not yet exist, namely, the forensic science of electronic handwriting analysis; and that further allows for the use by incorporation of the

other two forms of authentication into its system, as well as others that exist or may emerge in the future.

Still further objects and advantages will become apparent from a consideration of the ensuing description and accompanying drawings.

Drawing Figures

Fig. 1 shows authentication as a means of access by a web browser to a web server.

Fig. 2 shows how a web server "parses" or separates out for storage certain information transmitted by a web form page.

Fig. 3 shows the creation of the signature from database submission information and the system clock.

Fig. 4 is a representation of the machine process whereby the computer takes the signature token, wraps it in a digital wrapper, and signs it with the server's private key.

Fig. 5 is a representation of a web page as shown to the user which contains the signature button for signing the document.

Summary

In accordance with the present invention, an electronic signature program is described for the creation, monitoring, and verification of an electronic signature generated by the interaction between two computers for the signing of documents, filings or transaction records without the need for an expensive and massive infrastructure of certification authorities, without generating conflicts between applicable legal regimes in an international or multi-jurisdictional setting over regulation of encryption software, or without requiring hardware tablets and associated computer software. This system further

is able to incorporate other existing technologies designed to authenticate users and ones not yet available or existing.

Description – Figs. 1 to 5

The electronic signature is affixed between computers over the Internet. Figure 1 depicts the initial contact between an Internet user and an Internet server. This is accomplished by ordinary web browser. A method for authenticating users allows the additional option to screen out unauthorized users (fig. 1, no. 12). To access the signature device, users must pass the authentication gateway. Where unauthorized users are to be excluded, many different systems of screening out unauthorized computer users can be utilized, including but not limited to digital certificates to users from trusted third parties, previously issued passwords, stored and verifiable dynamic signatures, credit card authorizations, retinal scans and other authentication methods, without limitation. Unless the system is open to all users, unauthorized users are rejected by the system using the authentication system. If the system is open, the authentication mode is universal, and all users are permitted to create electronic signatures.

Information is collected from the users as shown in figure 2, (no. 14). It is transmitted for the purpose of (no. 15), parsing (separating out discrete information supplied by the user upon submission of a web page form that is specific to a filing, document or transaction)(no. 16) and storage of the information on the server computer (no. 17).

Creation of the signature is depicted in figure 3. Certain information from the user elements (no. 18) are combined with the date-time stamp of the system clock (no. 19) to create a unique blend of the components. (no. 20). This combination also permits a date and time stamp to be incorporated into the signature.

Figure 4 demonstrates how the signature is encapsulated in the digital signature of the server computer. An active X (com) object or other applications programming interface

(API)(no. 23) at the Internet server creates a digital wrapper (no. 24) and communicates with the signature program of the Internet server to sign the information (no. 22) contained in the signature (no. 21) with the server's private key. Once the signature is thus encapsulated and digitally signed, it is included in an automatically generated email message (no. 25). It is sent to the user at the email address that the user self-reported to the Internet server initially.

The digitally signed wrapper ensures that the information included in it, including transaction particulars, date and time stamp, and electronic signature cannot be altered after the fact without such change being detectable through software. Return of this information to the individual who signed the information is a receipt that is proof of the transaction, the electronic signature, and the transaction content.

If the email address is non-existent, intermediate mail server computers usually alert the server via a failed email message that the message was undeliverable. Such a message also serves to warn the server computer that a fraudulent transaction may be in progress.

Figure 5 depicts the mechanism for actually invoking the signature device, as viewed by the user. A simple button (no. 23) is clicked by the user, coupled with a clear warning (no. 24) of the consequences of clicking the signature button. Once the button is clicked, the electronic signature feature is enabled.

If the email receipt containing the electronic signature is received by the signer, that individual optionally may be required to countersign the receipt digitally (preferably using asymmetric encryption) and then to return the resigned message back to the server computer for storage and as further proof of receipt and authentication. This receipt at the server computer proves that the user actually received the electronically signed message, and the digital signature can be stored at the server as a further guarantee of message authenticity.

8

Conclusions, Ramifications, and Scope

Accordingly, it can be seen that the above system allows computer users to sign electronic documents, filings and transaction records submitted to another computer as though with pen and ink on paper, without any additional hardware or software apart from an Internet web browser. The signature program reduces the need for a massive infrastructure investment of certification authorities by relying solely upon the digital certificate of the server computer, without any similar requirement that the signing party obtain a separate digital certificate, unless optionally required for receipt signing purposes. The program eliminates certain legal problems that may arise from attempts by multiple legal regimes to regulate encryption features of asymmetric encryption program, through key recovery programs, since only one key, that of the server computer is involved, and only one legal regime will likely be entitled to regulate the server. The program is able to make use of other current and future technologies for computer user authentication systems, and is suited for the Internet and other computer networks.

Although the description above contains much specificity, this should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. Various other embodiments and ramifications are possible within its scope. For example, and not by way of limitation other unique system information of the server can be used in addition to or instead of the system clock to generate a unique signature token. Similar, the signature and the filing, document or transaction record to be signed and be digitally wrapped and signed using techniques other than asymmetric encryption.

Thus the scope of the invention should be determined by the appended claims and their legal equivalents, rather than by the examples given.